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NOTES ON PORTO RICAN HOMOPTERA

By

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NOTES ON PORTO RICAN HOMOPTERA

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INTRODUCTION

The following notes are based mainly on collections made during a brief visit to Porto Rico during the winter of 1928–1929. Previous records in the group have been made by VanDine, Smyth, Wolcott, Muir, Dozier and others, but all up to 1923 have been enumerated in Wolcott's INSECTAE PORTORICENSIS (**13**).

The larger part of my time from January 7 to March 20 was spent on the south side of the Island at Aguirre where my son, Herbert T. Osborn is located and where I had the advantage of assistance and courtesies from officers of the Aguirre Sugar Co. From February 5th to 14th was given to the north side where I had the kind cooperation of the Insular Department of Agriculture and the Insular Experiment Station, enabling me to visit many localities along the north shore and some of those of the interior.

While the abundance of the Homoptera had very evidently been greatly reduced by the severe hurricane of September 13, 1928 I was able to secure specimens from many points and to add a number of species to the known fauna of the island and some species which appear to be new to science.

Map of Porto Rico showing localities where collections were made in 1929.

It was impracticable to make trips to the higher mountain peaks but collections were made at various elevations up to above 2,000 feet. The larger number however were taken at near sea level and in regions largely under cultivation. Collections from the various important crop plants, sugar cane, coffee, tobacco, sweet potatoes, beans, etc., were made as fully as practicable. Collections on strictly native plants were confined largely to the beaches, *playas,* salt flats and former marsh lands adjacent to the coast and still occupied by a considerable element of the endemic flora.

Frequent rains especially when in the mountains, and high winds on almost every day in the field interfered to some degree with rapid work although the winds undoubtedly offset the burden of tropical sun and the attacks of mosquitoes and gnats which must be endured in the habitats most promising for interesting captures.

Frequent use was made of the valuable INSECTAE PORTORICENSIS by Wolcott (13) and the ECOLOGICAL SURVEY OF THE FLORA OF PORTO RICO by Cook and Gleason (1), the former as a guide to the known fauna and the latter especially for location of desirable collecting grounds and recognition of unfamiliar plants.

I wish to express my obligation to the Commissioner of Agriculture, Dr. Carlos E. Chardon, to Director R. Fernández-García of the Insular Experiment Station, Dr. Mel. T. Cook and Mr. Francisco Seín for generous assistance in visiting a number of localities on the north side of the island, and to the officers of the Aguirre and Guánica Sugar companies for many courtesies, while the help of my son, Herbert T. Osborn was of great service in finding suitable collecting localities in the southern part.

To Dr. N. L. Britton of the New York Botanical Garden, who was spending the winter on the island, I am indebted for a pleasurable collecting trip to Sabana Abaca and for the identification of a number of plants on which Homoptera were captured.

I am also indebted to the Graduate Council of the Ohio State University for a grant from their research fund to assist in the expenses incurred in securing the collections. The specimens collected, including the types of the species described as new, are included in the author's collections deposited at the Ohio State University.

SCOPE OF SURVEY

It has been my object to secure as full a representation as possible, in the time available, of the Homoptera occurring on the island as a basis for comparison with the fauna of other islands or

mainland regions and to show when possible the relation of the Porto Rico Homopterous fauna to that of other lands. Also to secure such data as might form a basis for some judgment as to the economic importance to the crops of the island and the ecologic relation to habitat and food plants.

For those unfamiliar with the island and as a general foundation for comment it may be stated that Porto Rico lies within the tropics from 17° 15′ to 18° 15′ north latitude, is about 110 miles long from east to west and 40 miles wide north to south; that there are a number of mountain ranges occupying most of the island, separated by fertile valleys and with a coastal fringe of 5 to 10 or 15 miles. The land is largely under cultivation even up to the tops of many of the hills and lower mountains and consequently the areas of endemic vegetation are very much reduced. The prevailing wind is east to west and of almost constant occurrence with velocity running up nearly to gales. Rains are of almost daily occurrence in the mountains and frequent in the north part of the island but less frequent in the south part. A part of the south-west section is almost arid, the rain being almost totally absent in the dry season and infrequent during the entire year. It is quite to be expected, therefore, that there should be considerable variety in the vegetation of different localities and necessarily much variety in character of insect life.

SOURCES OF HOMOPTEROUS FAUNA

If we compare the homopterous fauna of Porto Rico with that of Santo Domingo, Jamaica or Cuba we are struck with the much smaller number of species and the question naturally arises as to the explanation for such a paucity.

Wolcott (**13**) lists 39 Cicadellidæ and 33 other species of Homoptera (total 72) for Porto Rico, which includes the records made at the Insular Experiment Station through a number of years as well as such scattering records as have appeared in the numerous papers on Porto Rican insects up to the date of his publication (1923). While such collections were mostly made by persons not specialists in Homoptera still they must represent fairly well the occurrence of all but the rarer forms.

VanDuzee (**11**) has enumerated 102 species taken in Jamaica during a rather brief collecting trip on that island and the list would doubtless be increased if all recorded species were added. Osborn (**7**) listed 180 species in Cuba from collections made in February and March with additions of other records for that island. There is no detailed list for Santo Domingo and Haiti so far as I have noted

but in view of the scattered records from that island I am confident the numbers must far exceed those known to Porto Rico.

Some of the more striking occurrences for all the greater Antilles are *Agallia albidula, Cicadella similis* and *C. sirena, Kolla fasciata; Draeculacephala sagittifera; Xerophloea viridis; Spagbergiella vulnerata, Scaphoideus, fasciatus; Deltocephalus flavicosta, D. sonorus* and *D. balli? Euselis obscurinervis; Acinopterus angulatus* (*acuminatus auct.*) *Thamnotettix colonus, F. comatus and T. nigrifrons, Cicadula 6-notata, Eugnathodus abdominalis, Protalebra braziliensis* and *P. similis;* all of these having a very wide distribution in the neotropics and many of them occurring as far north as in the gulf states and some of them even in the northern states or Canada.

The species common to Porto Rico and South America are *Agallia stictigollis, Cicadella similis, Deltocephalus flavicosta, Euscelis obscurinervis, Thamnotettix colonus* and *T. comatus, Protalebra braziliensis, Empoasca fabae* and *E. flavescens.* Of the immense number of Cicadellinæ, many hundreds of species, and the great aggregations of species in the Cicadidæ, Membracidæ Cercopidæ and Fulgoridæ in South America. Porto Rico has almost none if we except the Delphacidæ which are represented by a number of species and some of these by hosts of individuals.

The species common to Porto Rico and Central America are with others *Cicadella similis; Kolla fasciata; Draeculacephala sagittiffera; Xeropholea viridis; Spangbergiella vulnerata; Scaphoideus fasciatus; Deltocephalus flavicosta; Euscelis obscurinervis; Thamnotettix colonus, T. comatus, T. nigrifrons; Eugnathodus abdominalis; Dikraneura marginella; Protalebra similis, T. braziliensis; Empoasca fabae, E. flavescens.*

It seems in general that there are fewer species common to South America than to Central America and many less than to other islands of the Greater Antilles or even to Florida.

Of the species common throughout the tropics most could have been distributed by human agencies as they occur on cultivated crops or grasses used for pasturage; as Para, St. Augustine, Bermuda, and Guinea grasses. Scarcely any of the endemic species seem to have any indication of original derivation from South America.

It may be noted that the principal winds and particularly the tropical storms—hurricanes—as well as regular trade winds travel from east to west and from south east to northwest and so far as wind agency is concerned and probably surface currents with drift on the water, the direction of dispersal would be from east to west. That is, Porto Rican insects might conceivably be carried to Santo

Domingo or other islands to the west but there would be much less probability of a return distribution. Porto Rico as related to the great expanse of the ocean is but a dot on the map and the chances of an insect reaching the island by natural agencies in such numbers as to stand a chance of establishment would seem to be quite remote.

Another phase of wind agency may be the possible depletion or even extinction of rarer species in Porto Rico by the devastating hurricanes which sweep the island and strip the vegetation of bloom, leaves and even twigs or branches while larger trees may be felled and killed. Such destruction must sweep away or destroy insects dependent upon particular host plants. Such storms have swept practically the whole island several times and such a one as occurred on September 13 last (1928) must have a tremendous effect on the leaf hopper fauna especially those species living on trees and shrubs. Those living on grasses or low herbage probably have a better chance of survival, or for some percentage of the population at least to survive, although I am told that large areas of grass land were so damaged by the last hurricane as to appear as if ravaged by fire.

Another factor to be noted is the immense change in the plant life of the island due to the intensive cultivation since occupation by man. It is well known that Porto Rico is one of the most densely populated areas of the world. It is probably less generally appreciated that this has resulted in the destruction of the native flora and as pointed out by Cook and Gleason (1) a very complete substitution of cultivated plants or a reoccupation by plants of foreign derivation. It is stated that only on the highest parts of the higher mountains is there what can be called an approach to the primitive conditions for the plant life. Practically all of the mountains have been denuded of the primitive forest and very many of them planted with crops of coffee, tobacco, bananas and other minor field or garden species and even sugar-cane fields are in some places carried well up on the hillsides.

It may seem rash to draw conclusions from records that are manifestly fragmentary, but collections in Porto Rico have been more extended and cover a longer period of time than for any other island of the group and while few of the collectors have been specialists in Homoptera a number have given sufficient attention to the group so that collections must be considered as fairly representative for the more common species at least. Moreover in my own collecting I have been able to secure examples of practically every species catalogued by Wolcott and in addition have added only 43 species of which seven appear to have been previously undescribed.

If, then, we are warranted in venturing any conclusion, it would be that in the long period of isolation represented in the history of the island, variously estimated as running back to Tertiary or Cretaceous time, there has been accession both by immigration and by evolution or modification a rather meager homopterous fauna; that the accessions by immigration include species mainly now common to the whole neotropic realm and that many have been brought in by the introduction of crop plants, possibly as long ago as during the migration of the aboriginal Caribs; that species developing on the island have been transported to adjacent islands and that there has been rather unusual opportunity for the elimination of species dependent upon the foliage of particular trees and shrubs.

Even where the endemic flora has survived as on some of the most inaccessible or infertile of the mountain peaks or in the gorges of some of the most precipitous mountain valleys the remnants of isolated plants offer poor opportunity for the perpetuation of fragile insects exposed to torrential rains and devastating wind storms. We have also to take account of the host of predators, lizards, birds, spiders and predatory or parasitic insects as well as presumptive fungous diseases as factors in the reduction or elimination of these insects. Altogether the Homoptera, especially leafhoppers in Porto Rico, have had a precarious and stormy life and the existing species represent stock which by rapid multiplication or adaptation to specially favored locations or special host plants have been able to maintain existence. Even those species of wide distribution occurring on cultivated plants appear to be kept within moderate numbers as compared with other regions and their economic importance therefore modified. Possibly at the time of my visit the abundance of the pasture and grass-feeding species had been much reduced by the recent hurricane but I nowhere found such swarms of leafhoppers as may often he observed in the States or in other tropical localities.

It is manifest that it is a hopeless task to determine certainly the point of origin and the paths of dispersal or the means of transportation for the numerous species now scattered thoughout the tropical parts of the western hemisphere. However alluring the problem as a speculation, its futility is too evident to warrant such discussion here. With the many changes in land connection and elevations or depressions which have changed the vegetation we can be assured that there has been extensive adaptations, migrations and extinctions in the history of such an island as Porto Rico.

HOST PLANTS

The Homoptera are essentially plant feeding insects and necessarily associated with such vegetation as may furnish suitable food supply. Many species are restricted to particular host species, others to certain groups of plant hosts, while a few seem to have the ability to live on a great variety of plants. In the main certain genera have limitations to certain genera or groups of plants as the species of *Deltocephalus, Euscelis, Cicadula* and *Eugnathodus* to plants of the grass family and most of the Typhlocybinæ to woody plants. It follows that the local distribution of species is mainly dependent upon the distribution of the flora and the ecological associations are almost entirely determined by the plant distribution.

ECOLOGICAL ASSOCIATIONS

I shall not attempt to discuss the various ecological associations of the island as a whole as my observations have been too limited to warrant such a discussion. However, there are some of the associations which I have studied that are so well marked that a brief discussion is in place especially as this will include mention of the relation of some of the cultivated crops of importance on the island.

Native Associations

Among the primitive groupings within which I have worked are the coastal complexes both of the beach and tidal flats or *playas* and while many of the Homoptera occurring here are by no means limited to such association there are some forms that are very distinctly restricted to the vegetation characteristic of this habitat.

On the sandy dunes which support a sparse growth of sea grape (*Coccolobis*) with associated plants will be found the common *Bothriocera venosa, Ormenis pymaea* and *O. marginata,* while the grasses and sedges will yield occasional specimens of *Deltocephalus trilobatus, D. maculellus* and *D. albovenosa; Chlorotettix minimus* and *C. tethys* and *Typhlocybella minima.*

The mangrove association seems quite free from Homoptera here although in Panama I have taken some peculiar species, but associated sedges, and especially the *Sesuvium* complex furnish some interesting species. A creeping succulent plant *Sesuvium portulacastrum* at Aguirre was found to be swarming with *Cicadella sirena* including many nymphs of various stages so that it must be counted a distinct host plant although the species is found on many different plants even

up to high altitudes, 1,000 to 2,000 feet. Also a remarkable rose-colored *Thamnotettix* (*T. rubicundula*) and several species of Fulgorids including *Oliarus franciscanus* and two or three species of Delphacids.

On the sedge *Fimbristylis spadicea* I took a peculiar highly colored species of *Eugnathodus* (*E. rosaceus* n. sp.) which so far as collections indicate is limited to this particular association though possibly occurring also on the associated *Cyperus laevigatus*. On the beach grass *Sporobolus virginicus* a few specimens of the wide-spread grass feeding *Euscelis obscurinervis* and some Delphacids.

In the forest association it has been more difficult to segregate species due to the intermingling of species and the limited opportunity to collect from isolated trees. The native *Cordia* is host to a striking species of Protalebra (*P. cordiæ* n. sp.)

The native grasses occurring on the hillsides were very sparsely populated with leafhoppers, possibly due to close cropping by cattle or goats or as a result of the hurricane and torrential rains of the September storm. *Deltocephalus trilobatus* taken on a hillside above Salinas at an elevation of 1,200 to 1,500 feet is the principal member in this association but the universally distributed grass-feeding *Deltocephalus flavicosta* is a frequent associate, and *Chlorotettix minimus* and *C. tethys* are occasional members.

Leaf Hoppers and Sugar Cane

As sugar cane is the most important cultivated crop in Porto Rico the leafhoppers associated with it are of special interest and I have given considerable time to observations in the cane-fields with the leafhopper population in mind. In many sugar-cane regions certain species of leafhoppers have proven of great importance, sometimes causing extensive losses but it may be stated that in general and especially for the season of my observation they may be counted as negligible, from the economic standpoint, in Porto Rico. However if the present species are comparatively innoxious it is of special importance to prevent the introduction of any of the species that have been destructive in other countries and it is evident that one of the most important phases of inspection and quarantine should be to know the possible menacing forms, their methods of transfer and best means of preventing their introduction.

I have elsewhere called attention to the importance of leafhoppers * from the standpoint of insect introductions and emphasized the desirability of extended surveys and studies of the tropical species

* Jour. Econ. Entom., Vol. 22, p. 1929.

with particular attention to their host plants and means of dispersal with reference to the southern states or to green-house crops in the north. It is certainly of equal, perhaps greater, importance in a tropical island such as Porto Rico which has so far escaped the introduction of many of the abundant and destructive species of South or Central America. With expanding commerce between the West Indies and the main land of South America and the isthmian region and the shortening of time by faster steamers or airplane communication there is an increasing probability of transfers of insects or insect eggs and it will certainly be the part of wisdom to maintain vigilant inspection of plant introduction and to use all possible means to secure knowledge of menacing species and their habits.

The common "Froghopper" of Trinidad which has been noted as a serious pest in sugar cane is a fair case in point as there would seem to be no reason to expect anything but rapid multiplication and serious damage in Porto Rico if this species should chance to be introduced and get a foothold in the island.

It is well known that species of little importance in their native habitat may assume major importance when brought into a region where they have abundant food and are released from the natural enemies of their home. The cane leafhopper which caused such havoc in Hawaii, and which very fortunately seems never to have been brought to the West Indies was brought under control by the use of native parasites from Australia but if it should secure a foothold in Porto Rico or any of the West Indian islands we could have no guarantee that the same parasites would be equally effective in its control as we cannot assume the same conditions of environment. Once the pest became established as a member of the local fauna no one could predict when or how often it might multiply in destructive numbers.

SYSTEMATIC AND FAUNISTIC NOTES

CICADIDÆ

No cicadas were collected during my stay in Porto Rico, probably because the species occur mainly at other times of the year, although Davis remarks that "It appears likely that a cicada may be taken in Porto Rico on any day of the year." Wolcott (**13**) lists two species, and Davis in a later paper (**2**) discusses these two species, one constituting a new genus and species. He remarks that since Haiti has six species known to him it may be that those for Porto Rico will be doubled in number. However, this discrepancy in number seems to agree with that in other groups and there is again a

very marked difference in number of species as compared with South America, where the family is very rich in species.

Proarna hilaris Germar.

This appears to be the most abundant form as numerous records are given by Wolcott and a number of additional ones by Davis. Davis says it seems to be most common from October to May.

Borencona aguadilla Davis.

Davis records the types from Yauco, and lists a number of other localities including those by Wolcott under *Zammara* sp.

Evidently further study is needed to determine exactly the cicadan fauna for the island but considering the large size and conspicuous character of these insects it is doubtful whether many more species will be found. Neither of the species known seem to be abundant enough to merit economic consideration.

(1) Insecta Portoricensis, Jour. Dep. Agr. of Porto Rico, Vol. 7, p. 256, 1923.

(2) The Cicadas of Porto Rico with a description of a new genus and species. Jour. N. Y. Ent. Soc., Vol. 34, p. 29–33, 1928.

MEMBRACIDÆ

Wolcott lists two species in this family, neither of which appeared in my collecting, probably on account of the season of the year or possibly from the absence of plants from which I had the opportunity to collect.

Antianthe expansa Germar.

Recorded by Wolcott for a number of host plants in localities scattered over the island.

Monobelus fasciatus Fabricius.

Wolcott records it on coffee and on several other host plants.

Nessorhinus vulpes A. & S.

This species was taken at Lares on shrubs or low trees and a specimen in the National Museum is recorded as from Mayagüez with determination by Funkhouser.

CERCOPIDÆ

No members of this family were secured in my collecting during the winter and Wolcott records only two species.

Epicranion championi Fowler.

Listed for coffee and for *Inga laurina* which is used as a shade

for coffee. The record would indicate that this species would be of economic importance in coffee plantations.

Philaenus fusco-varius Stal.

Mentioned by Wolcott as occurring on weeds and on mulberry.

BYTHOSCOPIDÆ

Agallia pepino DeLong & Wolcott.

This handsome little species was taken somewhat commonly in sweeping vegetation along roadside near Cayey Jan. 28, at an elevation of 2,000 to 2,100 feet and near Yabucoa Jan. 29, also at Río Piedras Feb. 8 and 14 and at Ciales Feb. 9.

Wolcott took it from carpet grass *Axonopus compressus* at Ciales and on sugar cane at San Sebastián. I took it at Ermita in Cuba Feb. 1925 and the species probably occurs in Santo Domingo and Haiti.

Agallia pulchra DeLong & Wolcott.

One specimen of this handsome species from roadside vegetation near Cayey. Jan. 28 and others March 16, 2,100 feet elevation, one on vegetation on cliff, Lares, Feb. 12, altitude 1,200 to 1,300 feet. The experiment station collection contains four specimens, two male and two female, not seen by DeLong. One only with bright orange on pronotum, others with the yellowish disk and black central line in front and two black dashes behind the eye. One male, with the dark patch on disk. Male plates slender, tapered; female segment truncate, incised at middle. Black on claval veins broken; tips of clavus yellow.

Agallia sticticollis Stal. (*A carrotovora* De Long & Wolcott.)

Taken at San Juan on Sweet Potato Feb. 8. Recorded as from carrots by Wolcott (1923). The DeLong type and the specimens I collected appear to be identical with specimens from Brazil which I have identified as *A. sticticollis* Stal. This gives it a wide range and furnishes an instance of the occurrence of a South American species in Porto Rico.

Agallia albidula Uhler (*A. tenella* Ball.?)

Common on *Amaranth* sp. near Salinas in cane field. An abundant species throughout the island and in the Lesser Antilles, Cuba and doubtless in San Domingo and Haiti. Many localities. Guayama Jan. 14, Cayey Jan. 24, Yabucoa Jan. 29, Sabana Abaca Feb. 5, (*Hyptis* association) Arecibo Feb. 13.

CICADELLIDÆ

Cicadella similis Walker.

This species is very widely distributed throughout the West Indies and parts of South America, Central and subtropical North America and seems to be everywhere present in Porto Rico, occurring on a great variety of plants especially the "malojillo" grass (*Panicum barbinode*). It occurs occasionally on sugar cane and Wolcott records nymphs and eggs as well as adults but in my own collecting I have taken only adults and it seems probable that occurrences of eggs and nymphs are exceptional and that the migrations to cane result from the clearing out or ripening of the grass plants which have served as their hosts. It is seldom abundant on Guinea grass as compared with the "malojillo" but on some of the pasture grasses it must really be destructive and to be counted of economic importance. Wolcott's (13) records for grape fruit, coffee and some other plants, not of the grass family are probably based on captures of adults occurring only temporarily or accidentally on these plants although in my own collecting they have been taken in many unexpected places. Nymphs are taken in January and there is probably more or less of overlapping of life history throughout the year and considerable migration of adults determined by the succulence of available food plants. I have found it under very similar conditions in Mexico, Cuba, and the Canal Zone and other places.

The species has received considerable attention from entomologists, Smyth having used it in experiments with transmission of mosaic and Wolcott treating its life history and economic status. Further the records of its occurrence in different countries extend back for many years at least to the middle of the last century.

Cicadella coffeaphila Dozier.

Dr. Dozier describes this species as occurring on coffee and remarks that it was abundant at many points. No trace of the species was found on any of the coffee trees I examined and considering the almost complete defoliation of trees in all the plantations I visited I should think there would have been little chance for survival of these insects.

This and *C. coffeacola* were included under *C. occatoria* in Wolcott's paper but Dozier (4) points out the differences.

Cicadella coffeacola Dozier.

This species like the preceding was described as occurring on coffee and Dozier mentions its abundance in many coffee-growing local-

ities. No specimens were found in any of the plantations visited although I made a special effort to collect from coffee trees.

Cicadella sirena Stal.

Wolcott lists this species as occurring on a large variety of plants including grasses, garden vegetables, grape fruit, weeds and sugar cane. I took it at nearly all points where collecting was done and upon a considerable variety of host plants at different elevations. At Aguirre it occurred in all stages on *Sesuvium* in the salt flats so that there can be no question that this plant serves at times as a perfect host plant for the species. It was also taken near Ponce from *Barita* which may also serve as a host plant although it was found on this plant on but one occasion. Other localities are Sabana Abaca Feb. 5, Arecibo Feb. 13, Salinas Jan. 21. When occurring on garden crops and other cultivated plants of economic value it must be counted injurious.

Kolla fasciata Walker.

This is another neotropical species of very wide distribution in tropical and subtropical America. It is a common species in Porto Rico and has been taken at most of the localities where I have collected. Guayama, Aguirre, Salinas, Guánica, Yabucoa, Río Piedras, Lares, Ciales, Arecibo, Vega Alta and other points throughout the time of my visit. It occurs on a number of different species of grass and may be swept from mixed vegetation of great variety although probably its natural food plants are in the grass family. It is often in such abundance that it must be counted of economic importance. Wolcott (**13**) records it for the "St. Augustine, Bermuda and Carpet grass, on sugar cane and malojillo." I have taken it commonly in sweeping mixed grasses and weeds especially on hillsides.

Draeculacephala sagittifera Uhler.

This species may be expected to occur at every point where Bermuda grass is present as this seems to be its favorite host. Adults are abundant and active throughout the winter. While the grass does not appear to show great evidence of the work of the insect there can be no doubt that where these insects occur by the millions, as is often the case, there must be a heavy drain on the plants and a corresponding loss in forage value to the live stock pastured on the infested fields. Wolcott gives a record for sugar cane but this can hardly be counted a normal host.

Xerophloca viridis Fabricius.

This species occurs from Southern South America to Northern

United States and often in great abundance. Only scattering specimens have been taken this season and I think it must have been reduced in numbers by the storm. Records for Guayama Jan. 12, Aguirre Jan. 17, Guánica on grass Jan. 18, on *Bærita* near Ponce March 2. Wolcott records it as common on carrots but it is generally found on grasses and probably breeds mainly, if not entirely, on species of the grass family.

Xestocephalus pulicarius Van Duzee.

This widely distributed species, included in Wolcotts catalogue, was taken in small numbers at Aguirre, Feb. 12, Sabana Abaca, Feb. 5, Guayama, Feb. 7, Río Piedras, Feb. 8, Lares, Feb. 12, Cayey Road, 2,000 ft. elevation, Mar. 16.

Xestocephalus maculatus n. sp.

Head small; vertex broad half longer at middle than next the eye, front convex, polished. Pronotum longer than vertex widening posteriorly. Elytra narrowing to apex. Female last ventral segment slightly notched; pygofer with dense setæ. Male valve hidden; plates elongate, triangular, densely setose.

Dark brown with numerous black or fuscous maculations. Costa of elytra beyond basal third with alternating squarish tesselations, black and whitish or subhyaline and about ten conspicuous white lots on each elytron and two small elongate spots on apical ends of claval veins; veins of apical half blackish.

Length 3.25 mm.

Described from a series of specimens (type female, allotype male, and paratypes) collected on the Cayey Road, Jan. 28 and Mar. 16, at about 2,000 ft. elevation, most of them from *Inga* trees, which appear to be normal host plants. It is the size and form of *X. tesselatus* but much darker and the picture quite different.

Spangbergiella vulnerata Uhler.

This species was taken at several different points but in small numbers and usually upon Guinea grass which appears to be a common food plant. Specimens were secured at Aguirre from Guinea grass pasture and there are records for San Juan, Río Piedras and there are specimens from Vieques in the Experiment Station. Wolcott's records include one from "Sugar cane and malojillo grass".

Scaphoideus fasciatus Osborn.

Specimens of this species were taken at a number of different points, always in grass land and in connection with Guinea grass but not restricted to this one species. Guayama, Jan, 12, Aguirre,

Jan. 17, Feb. 2, and Añasco, March 1, Sabana Abaca and beach near San Juan, Feb. 5.

This species, while fairly common is not sufficiently abundant to be counted of economic importance judged by collection made during the winter. The numbers may have been reduced as the result of the storms or of dry weather.

Scaphoideus bimarginatus DeLong.

This was described by DeLong (1923) from one female collected at light at Pt. Cangrejos, Feb. 27, 1920, by Wolcott, but no other Porto Rican specimens have been noted. I collected it from Cuban pines at Herradura, Cuba in March, 1925, and also at Ermita without host record. If the species is restricted to West Indian pine it may be looked for at intervening points from Porto Rico to Cuba.

Platymetopius loricatus Van Duzee.

Two specimens of this species were secured at Aguirre, Feb. 18, in sweeping mixed vegetation on waste land at sea level. The species is common over the southern United States and in Central America. The Porto Rican specimens agree perfectly with those from Guatemala in my collection. This is probably the species given as "*Platymelopius* sp" "on string beans" in Wolcott's list.

Deltocephalus trilobatus DeLong.

A number of specimens of this well marked species were swept from a native grass on the rocky mountain side in Salinas valley at some 1,500 to 1,800 ft. elevation. The grass was scant but pastured and in places close cropped and the leaf hoppers evidently rare as they were secured only by persistant sweeping and then in but small numbers. The markings agree with DeLong's description but the triangular spots at anterior angle of vertex are brown rather than orange. There are conspicuous fuscous blotches in a discal cell and in first and second apical areoles.

The species has been taken also at lower elevations, but in very small numbers and can have little economic importance. Arecibo, Beach at Sabana Abaca, and Aguirre.

Deltocephalus sonorus Ball.

Taken at Central Aguirre on grass. This species has been recorded for a wide range of territory having been described from specimens taken in South Western United States and common in the Gulf states and Cuba. Wolcott records it "On malojillo grass at Pt. Cangrejos". I have found it only in small numbers and it can have little economic importance here unless there are times when

it becomes much more abundant. It probably occurs on several different kinds of grass.

Deltocephalus maculellus Osborn.

Specimens of this species which was described originally from the eastern part of Cuba were taken at Guayama, Jan. 12, Coamo, Jan. 13, and Fortuna, March 15. They agree perfectly with the type specimens and it is probable the species will be found in Santo Domingo and Haiti. The species of grass is not known.

Deltocephalus albovenosus Osborn.

This species was described from Cuba and specimens were taken in Porto Rico at San Juan, Feb. 10, Luquillo, Feb. 11 and Añasco, March 1. All these localities are at or near sea level and specimens were from beach grass or similar association.

Deltocephalus nigripennis DeLong.

DeLong described this species from "one male swept from grass at Boquerón". I have not taken any specimens that answer his description or agree with his type but the species is evidently quite closely related to one I described as *D. flaveolus* from Cuba, differing in the picture of elytra.

Deltocephalus flavicosta Stal.

This species is very widely distributed in Tropical America and north to the Great Lakes in the United States. It has been taken in Porto Rico at practically all points where I collected and from sweepings on grasses of different kinds. While not particularly abundant during the season it evidently succeeded in establishing itself generally after the storms and may be expected to increase in favorable locations. It is one of the common species in pasture lands, occurs upon Guinea grass and is one of the species that seems well established on this pasture grass and it was taken at Mayagüez on Guatemala grass. It shows considerable variation in the intensity of coloration and the typical dark form merges into lighter varieties. It may be counted distinctly an economic species but if not more abundant than during the past winter cannot be counted a serious pest.

Euscelis obscurinervis Stal (=exitiosa Uhl.)

This common and very abundant species throughout the tropics has an extension in the United States to its northern border and is common on a great number of grasses, but in the tropical regions or within the range of distribution of Bermuda grass seems to be

particularly plentiful on this species. In Porto Rico it was taken everywhere that suitable grasses were available and in some localities, in considerable numbers. Nymphs were found during most of the season and at practically all localities. It is of distinct economic importance on forage grasses except perhaps for Guinea grass where I did not find it present in any numbers.

Euscelis striola Fall.

Recorded by Wolcott but not taken in any of my collections.

Acinopterus angulatus Lawson.

Specimens collected in Porto Rico agree closely with paratype material in my collection used by Dr. Lawson. The West Indian specimens generally according to Dr. Lawson will fall under this name.

Guayama, Jan. 12, Aguirre, Jan. 18, Sabana Abaca, Feb. 5, Salinas, Mar. 12.

Thamnotettix colonus Uhler.

This is an abundant species throughout the West Indies and the coastal states of the United States, and also in Central and South America. Its range may be considered as covering the entire neotropic region and the sub-tropical part of the United States. It occurs on Bermuda and St. Augustine grass and apparently its range coincides pretty closely with the distribution of these grasses although it does not seem to be particularly confined to them as food plants. It was taken in Porto Rico in all localities where these grasses occur. Guayama, Jan. 12, on the Cayey Road at elevations of about 2,000 ft. on Jan. 28, at Yabucoa, Jan. 29, Patillas, Jan. 25, San Juan, Feb. 5, Río Piedras, Feb. 8 and 14, Vega Alta, Feb. 6, Cataño, Feb. 7, Ciales, Feb. 9, Lares, Feb. 12, Arecibo, Feb. 13, and Aguirre, Jan. and Feb. The species would be of considerable economic importance if the host plants were used extensively for forage. It did not appear in the Guinea grass pastures and consequently does not seem to be of consequence in the principal pasture areas of the island.

Thamnotettix cubana Osborn.

This species was described from Cuba and has been taken most commonly on Guinea grass but sometimes in mixed areas of grass land. Records for Porto Rico including Guayama, Jan. 12, Aguirre, Jan. So far as present season observations go, the species does not appear to be abundant enough to have special economic importance.

Thamnotettix nigrifrons Forbes.

This species is very common throughout the West Indies and United States and has been recognized as an important economic species affecting grasses and also at times attacking small grain crops. The Porto Rican specimens are quite pale, the face with rather faint black bars but the venation and other structural characters agree closely with typical forms for the United States. Specimens were taken at a number of localities, especially at Santa Rita, Luquillo and Loíza (Old).

Thamnotettix comatus Ball.

The record in Wolcott's catalogue for specimens occurring on carrots appears to be based on specimens which agree with *T. cubanus*. Specimens collected at Río Piedras agree very well with what I have as *T. comatus* from Central and South America, including specimens from the type material from Orizabo, Mexico, used by Dr. Ball, and on these I have based the record of the species for Porto Rico.

Thamnotettix rubicundula Van Duzee.

Head subangulate, wider than pronotum: vertex longer at middle than at eye. Pronotum longer than vertex. Elytra with conspicuous venation. Female last ventral segment about twice as long as preceding, slightly concave, deeply and rather broadly incised at middle half way to base, incision bordered with dusky or black, with crescentric sub margin at inner end—pygofer borders in some cases darkened. Male valve broad, as long as preceding segment broadly rounded behind, plates short, almost truncate, hind margin with short spines or hairs about equalling pygofer in length; styles exposed and black tipped.

Color uniformly rosy, fading to yellowish both above and below; the elytra subhyaline but suffused with rose color. The veins conspicuously red and, especially in males, a slight tendency to smoky on the apical part; legs a little paler and the tibial spines more or less blackish.

Length female 3.5 male 3.25 mm.

Described from a large series of both sexes. Collected on *Sesuvium portulacastrum* at Aguirre, Feb. 20 and at Coquí, Feb. 22 and Ensenada, March 11. This is evidently the restricted host plant as the species has not been taken from any other plant and nymphs of all stages or sizes have been taken with the adult.

The nymphs of different instars are like the adults and the color agrees with the abundant reddish patches of the host plant which

occur in extensive mats often with no other form of plant on the salt flat adjacent to the sea shore.

VanDuzee described his *T. rubicundula* from a single female collected in Jamaica with no indication of food plant and I know of no further record of the species. I had considered the species undescribed and prepared the above diagnosis but careful comparison with the Van Duzee description convinces me that they must be identical. As my description covers both sexes and the nymphs it seems desirable to include it in full.

Chloretettix viridius Van Duzee.

I took one example of this species at Luquillo, Feb. 11 and Wolcott lists it "at light at Pt. Cangrejos". This would indicate that it is quite rare, at least for the season of collecting, although in the southern United States, it is a very abundant species.

Chloretettix nigromaculatus DeLong & Wolcott.

No specimens of this species were taken during my stay on the island and as the species was described "From a single female at light at Río Piedras" nothing is known as to its food plant. There are two females from Gualan, Guatemala in the Ohio State University collection which agree with the type specimen from Porto Rico and which indicate a considerable range for the species. It may be expected to show up in Haiti, Cuba and probably other tropical localities.

Chlorotettix minimus Baker.

This species has a wide distribution in the tropical Americas from Brazil to Florida, but was not found in abundance at any point during my stay in Porto Rico. Ordinarily it may have considerable economic importance. Taken at Patillas, Jan. 22, Arecibo, Feb. 13, Espinoza, Feb. 6, Guayama, Jan. 12, Feb. 27, Añasco, Mar. 1, Fortuna, Mar. 15, Río Piedras, Feb. 8, Feb. 14, Aguirre, Jan. 18, Ponce, Jan. 21 and Mar. 15.

Chlorotettix tethys Van Duzee.

Chlorotettix tethys VanDuzee. Bul. Buffalo Soc. Nat. Sci., Vol. V, p. 71, 1907.

Chlorotettix bidentatus DeLong, Jour. Dept. Agr. Porto Rico, Vol. VII, p. 264, 1923.

Light green with no dark markings on head, pronotum or scutellum but with more or less distinct fuscous or blackish spots on the clytra; a faint dash next apex of inner cell of clavus, two distinct roundish spots, one on the base of the outer claval cell and one in

base of discal cell and two oval or quadrate fainter blotches beyond the middle with smoky tint in apical areoles. Elytra greenish hyaline with faint iridescence. DeLong says of color "Dull greenish yellow, unmarked" and in his type specimen the dusky spots of elytra are scarcely visible, possibly due in part to fading.

Nymphs taken with adults Jan. 23 '29 at Salinas valley on mountain side, bright green, no marking with short scattered blackish hairs on abdomen.

This was the most common species of the genus during my stay in Porto Rico and taken in a variety of habitats, mainly on grasses. San Juan, Feb. 10, Aguirre, Jan. 18, Patillas, Jan. 22, Ponce, Jan. 20. Wolcott records it under *C. bidentatus* on sugar cane, weeds and sweet potatoes.

VanDuzee's description was based on three females collected in Jamaica in 1906. A careful comparison of my specimens in which there is considerable variation in extent and intensity of the dark dots with Van Duzee's description and the description and type specimens of DeLong's *C. bidentatus* convinces me that they are the same.

Jassus obligatus Uhler.

Recorded as from leaves of *Ficus laevigata* at Quebradillas by Wolcott. It did not appear in my collecting.

Cicadula 6—notata Fall.

Taken from grasses at a number of points. A common species, often destructive to grasses and small grain. Its distribution covers most of Europe, and North America to the Canal Zone.

Cicadula 6—notata var.?

Taken on the Cayey Road at near 2,000 ft. elevation. This is larger than typical 6—notata and the black dots on the vertex are broader more squarish and the elytra are clouded more or less with fuscous, forming a fairly definite yellowish white saddle back of the scutellum.

Cicadula maidis DeLong.

This is a distinctly marked species, nearly pure white with two conspicuous round black spots on the vertex close to the anterior border. Specimens were taken in a garden at Ciales, Feb. 9, where a few hills of corn were growing among beans, but not taken where corn was absent. At Río Piedras several small specimens were taken on a vacant lot with mixed weeds and grass but no corn, and specimens were also taken one evening at light at Dr. Cook's residence.

Also at Arecibo, Feb. 13, Mayagüez, Mar. 2, Guayama, Feb. 27. Corn is no doubt its ordinary host as nymphs occur with adults on this plant. Outside of Porto Rico where it was first discovered it has been taken in Cuba.

Balclutha hyalina Osborn.

This species was described by the author (1926) from specimens collected on a sedge at Jaronú, Cuba, and specimens agreeing with the type material were collected in Porto Rico on Cayey Road near Cayey at about 2,000 ft. elevation.

Eugnathodus virescens Osborn.

Examples of this species originally described from Cuba were taken at Río Piedras, Feb. 14 from grass on Insular Experiment Station grounds.

Eugnathodus pallidus Osborn.

Taken at Río Piedras, Feb. 14. Heretofore known from Cuba only.

Eugnathodus abdominalis Van Duzee.

This very widely distributed species in the United States, Mexico, Central America and West Indies was included in Wolcott's list and taken by the writer at Lares, Feb. 12, Arecibo, Feb. 13, Fortuna, Mar. 15, Mayagüez, Mar. 2, Río Piedras and Cayey Road but in smaller numbers, and evidently scarce during the season.

Eugnathodus minutus n. sp.

Small, slender, head distinctly wider than pronotum, slightly tumid; eyes prominent; vertex a little longer at midle than next the eye; pronotum short, longer than vertex; elytra narrow, costa only slightly curved. Female last ventral segment truncate, one half longer than preceding. Male valve hidden or wanting; plates small, triangular, reaching tip of pygofer.

Color pale ash gray, almost white, face and pronotum faintly tinged with yellow or buff; pectus blacknish, legs white; abdomen tinged with greenish.

Length, female 2.75 male 2.50 mm.

Described from a series of five specimens, female (type) male (allotype) and paratypes collected from matted grass at sea level, salt flat association. Aguirre, Feb. 18 and 23, 1929. This is the smallest species known to me; smaller than pallidus or abdominalis which it resembles in form but there are no traces of the stripes on head and pronotum, usually conspicuous on the latter.

Eugnathodus guajanae DeLong.

The arrow leaf hopper, *Eugnathodus guajanæ,* described as occurring in "arrows" of cane was taken in small numbers from cane "arrows" on the few occasions when I had opportunity to examine them and then only by vigorous beating, never on cane not in bloom. It was taken frequently in sweeping grass even when far distant from cane and it seems evident that it is a general grass feeder and occurs on cane only when it is in bloom. As its presence in the arrows can have very little economic importance unless it is shown to be a carrier of some plant disease its relation to cane may be considered negligible. On grass it may be of some consequence although in collections that I made it has never appeared in great abundance but most commonly on native grass which has possible forage value on the hillsides.

Like many other species its importance depends on abundance on a crop of agricultural value and it may have been much less abundant the past winter on account of storm.

Eugnathodus bisinuatus DeLong.

Recorded by Wolcott for several localities and described as from seed heads of malojillo grass, *Panicum barbinode.* Also mentioned as occurring on sugar cane, sweet potato, carrots, sedge and bermuda grass. I collected it at Vega Alta Feb. 6 and Río Piedras Feb. 8, etc.

Eugnathodus rosaceus n. sp.

Head slightly wider than pronotum; vertex short, rounded anteriorly, faintly angulate, two thirds as long as the pronotum; female last ventral segment as long as preceding and broadly rounded on posterior border. It is quite distinctly polished as are other segments of the abdomen in most specimens.

The color is a bright pink or reddish rose color, specimens varying from bright pink to reddish or rose red, the whole body above and beneath as well as elytra being suffused with the color in varying intensity.

Length 3.5 mm.

Described from a series of twenty females collected from seed heads of a sedge *Fimbristylis spadicea* at Aguirre Feb. 18 and 23.

Protalebra cordiae n. sp.

Head scarcely as wide as base of pronotum; vertex subangular, rounded to front; elytral appendix narrow. Female last ventral segment elongate, twice as long as preceding segment and narrowed, produced on hind border with a median black tip. Pygofer with

pale bristles; ovipositor yellowish. Male plates narrow, elongate, tapering to acute tips extended to tip of pygofer. Under and seen through the subhyaline plates near the base two points are visible, probably tips of male claspers.

Color white, the head with disk of vertex, a band between eyes and lower part of face yellow; propleura and base of elytra orange, tip of scutellum black. Elytra tinged with greenish, crossed by an oblique black line at middle of clavus, bordered behind with white; four black longitudinal lines or dashes, one, short, on clavus, two sinuate or arcuate on disk of corium and one strongly arcuate near costa reaching to cross veins where they merge with a black line before the crossveins; cross veins white, bordered behind with black which extends along costa to apical cell; the membrane clouded with smoky on the disk; tibial spines and tarsal claws black.

Length 2.5 to 3 mm.

Taken in numbers from *Cordia* sp. at Aguirre, males, females and nymphs occurring on the under side of leaves Jan. 17 and Feb. 18. Also at Coamo, Jan. 13, 1929.

The nymphs associated with the adults and quite certainly of this species, though not bred, are white, faintly tinged with yellow and in fresh specimens the eyes are greenish white as in the adults. The head, thorax, wing pads and abdomen are set with scattered, stiff, black hairs.

The species is somewhat similar to *P. curvilinea* but the picture is different. It has been taken only on the *Cordia* which may be considered a normal if not an exclusive host.

Protalebra lenticula n. sp.

Head as wide as pronotum, vertex produced, subangulate, rounded at tip, as long as pronotum; pronotum narrowed anteriorly, strongly curved, hind border scarcely concave; scutellum small, tip acute; elytra with costa distinctly convex, appendix narrow. Female last ventral segment elongate, angular; male, valve minute or hidden, plates elongate triangular, with acute tip, borders with white cilia.

Ivory or milky white, the anterior part of pronotum banded or suffused with pale orange, scutellum with black dots in the angles, the apical one larger; elytra milky hyaline, a distinct curved narrow blackish band just back of the scutellum, preceded by an orange brownish area, central part forming a broad white saddle or band with two faint longitudinal golden yellow stripes reaching to a broad blackish band with angular anterior projections on cross nerveures, and faint smoky patches on the membrane.

Length 2.5 mm.

Described from a series of fifteen specimens, ten females, five males, female (type) and male (allotype) and thirteen paratypes in authors collection collected at Coamo, P. R., Jan. 13, 1929.

Protalebra similis Baker.

A specimen collected at Espinoza in low ground mixture of weeds adjacent to tomatoes. A previous record by the writer in Annals Carnegie Museum (1928 p. 264) is based on a specimen from Vega Baja which is, rather curiously, not distant from the point where I took the specimen here recorded. I have also a specimen from Mayagüez collected by Mr. W. V. Tower.

Protalebra ziczac n. sp.

Head produced, vertex angular, as long as pronotum, a trifle longer than width between the eyes; elytra long, appendix narrow at base, widening to apex. Female last ventral segment long, twice as long as preceding, hind border nearly truncate.

Pale yellow, vertex and pronotum tinged with orange, base of vertex and three diffuse spots on disk, base of pronotum except for a narrow black line, inner border of clavus and zigzag lines on the elytra whitish, borded with black; base and apex of clavus and discal area on corium greenish orange; cross veins in part yellow; apical veins white bordered with blackish; beneath pale yellow or whitish, base of apical tarsal joint dusky.

Length 2.75 mm.

Described from one female (type) swept from mixed grass and weeds near Mayagüez in the Añasco valley Mar. 1, 1929.

This has the general appearance of *similis* but the white markings on the elytra have a distinctly different angular picture.

Protalebra tabebuiae Dozier.

Protalebra tabebuiae Dozier. Jour. Dept. Agr. Porto Rico, Vol. X, p. 260, 1927 (Sept.).

Protalebra bicincta Osborn. Annals Carnegie Museum, Vol. XVIII, p. 259. 1928 (May).

I took this species in considerable numbers from "robles" on the Station grounds at Río Piedras. One small tree was so much infested as to have the leaves whitened. Apparently restricted to this tree as a host plant as no other occurrences have been noted. I described the species from specimens sent me by Dr. Dozier but publication was delayed and his description, appearing a few months before mine was printed had failed to come to my notice. In my note with the description the word "robles" has been translated for

me as "oaks" but the name roble is applied in Porto Rico to trees of the general *Tabebuiæ* and *Bourreira* according to Cook and Gleason.

Protalebra bifasciata Gillete.

Dozier (4) records a specimen taken by beating a thorny leguminous bush at Juana Díaz Feb. 11, 1925.

Protalebra aureovittata DeLong.

Alebra aureovittata **DeLong.** Jour. Dep. Agric. Porto Rico, Vol. VII, p. 267. 1923.

Protalebra pallida Osborn. Annals Carnegie Museum, Vol. XVIII, p. 260. 1928.

Specimens were taken at Yabucoa Jan. 19 and on the Cayey Road near Cayey at about 2,000 ft. elevation on Jan. 28.

The specimens I described as *pallida* from San Sebastián have the yellowish stripes very faint but I believe they should be placed with the other under one specific name, though additional material may warrant a varietal name.

Empoasca sex-maculata DeLong.

Described from specimens taken from "emajagua" *Partium tiliaceum* at Pt. Cangrejos. No specimens were encountered in my collecting.

Empoasca fabae Harr. (*E. mali.* auct.)

Abundant and destructive throughout Tropical America and in United States north to Canada. Affects beans, potatoes, etc.

Taken at many points. On morning glory, beans etc.

Empoasca flavescens Fabricius.

This is entered in Wolcott's list on authority of Dr. DeLong and it is difficult to separate records which may refer to this species from those referring to *E. fabæ*. The two species have been confused in literature and until more definitely separated it will be difficult to place the various records.

Empoasca minuenda Ball.

This was described as occurring on avocado leaves in Florida and Dozier records it from the same host in Porto Rico.

Joruma pisca McAtee.

Recorded by Dr. Dozier as collected at Aguirre.

Joruma brevidens DeLong.

A specimen referred to this species was taken near Loíza (old) sweeping a rank weed at margin of river, close to wild cane.

Described as *Empoasca brevidens* but DeLong (3) remarks that the venation differs from that of typical *Empoasca*—and it evidently belongs to the group later characterized as *Jorumo* by McAtee (5).

Dikraneura marginella Baker.

In mixed grasses at Experiment Station. One specimen. This species was not recorded by Wolcott but is common to West Indies and Central America to the Canal Zone.

Dikraneura (Hyloidea) **depressa** McAtee.

McAtee described this species from specimens taken by G. N. Wolcott at Vega Alta and Dozier (4) repeats his description and adds other records. It did not appear in any of my collections and may be rare.

Typhlocybella minima Baker.

Common to sub-tropics or neotropic America. Occurs probably on a variety of grasses of which Guinea grass is definitely one. Taken in Porto Rico at Yabucoa Jan. 29, Río Piedras, Feb. 8, Arecibo, Feb. 13 on grasses, at Aguirre on Guinea grass, Feb. 20 & 29. The species may have economic importance as it occurs quite commonly on pasture grasses.

FULGORIDÆ

Bothriocera venosa Fowler.

Taken at a great many localities and in a variety of habitats from Mangrove association in salt flats to mountain roadsides.

Oliarus franciscanus Stal. (=*Oliarus cinereus* Wolcott)

One of the most generally distributed species of Fulgorid and occurring in great variety of habitats. Adults occur on a great variety of hosts and Mr. Seín * has found that the nymphs occur on the roots of sugar cane and malojillo which has a very interesting possibility in the transmission of mosaic or other diseases.

The species is known throughout the tropics and over a large part of the United States and has received several latin names due to this wide distribution.

Cubana tortriciformis Muir.

Described by Dr. Muir from one female from Mameyes 3,000 ft. elevation. I have not recognized it in any of my collections.

Cedusa inflata Ball ?

Specimens collected at Añasco March 1st are referred with some doubt to Dr. Ball's species described from Haiti.

* Annual Report, Insular Experiment Station of Porto Rico for 1927–28 (1929) p. 90.

Cedusa edentula Van Duzee.

A number of specimens collected at Añasco March 1st agree very well with specimens in my collection. The species has been known heretofore from New Jersey to North Carolina and if our identification is correct it means a much wider distribution for the species.

Cedusa wolcotti Muir.

Dr. Muir described this species from material collected at Yauco, August 24, 1923 and said to be feeding on Palm. In my own experience I found the palms very free from any of these insects, but they may have a seasonal occurrence. None of my specimens seem to agree with the description of this species.

Dysimia maculata Muir.

Reported in the description as feeding on two species of *Inga*, *I. vera* and *I. laurina* in August.

Parahydriena hyalina Muir.

Dr. Muir in his description states that the specimen of female from which his description was drawn was from Lares June 14, 1921.

Tangia angustata Uhler.

Recorded by Wolcott from several food plants. Not recognized in my collections unless specimens from *Guilandina crista*, near San Juan, may possibly be referred here.

Neurotmeta sponsa Guerin.

One specimen which seems to agree well with the descriptions of various authors for *sponsa* was collected from a small tree on the Cayey Road near Cayey at an elevation of about 2,000 ft. It is pale yellowish green, the elytra hyaline tinged with yellowish.

Monopsis viridis Walker.

Specimens, agreeing with Walkers description, were collected from Mangrove, *Conocarpus erecta* at Aguirre. Feb. 18 and from various woody plants at Salinas, Mar. 12. I do not find later records for this species and it may have been referred to some earlier described from but the description as given by Walker (1851) fits my specimens very exactly.

Catonia intricata Uhler.

Uhler's description was from one specimen from St. Vincent and while apparently a little larger I think the characters given warrant placing the Porto Rican specimens here, at least tentatively. One specimen from Yabucoa Jan. 29 and one from Lares Feb. 12.

Pintala (Cotyleceps) **decorata** Uhler.

A single specimen referred to this species was taken at Lares Feb. 12. Uhler's specimen was from St. Vincent and he established the genus *Cotyleceps* to include it but Muir places the genus as a synonym of *Pintala* Stal.

Thionea sp.

Wolcott includes a record under this heading as "det Muir" but I did not secure any specimens of the genus.

Colpoptera brunneus Muir.

Dr. Muir lists Utuado, Toa Alta, "Cicales" (sic) Ciales (?) as localities from which type material was used. This is probably one of the forms included under *Cyarda* in Wolcotts "Insectae" as he mentions "Ciales" as one of the localities under that name.

Colpoptera maculifrons Muir.

Muir's description is based on one male collected at Río Piedras by R. T. Cotton, Jan. 10, 1917.

Specimens referred to this species were taken at many points but occurred in large numbers, both as adult and probably nymphs, on "fiddle wood" (*Pedula*)? at Salinas, March 1. It was taken on sea grape as adult at Cataño and Salinas and in sweeping from *Lantana* at Yauco, and on *Barita* at Tallaboa, March 11. What appear to be nymphs were swept from shrubs and bunches of grass at Salinas in Feb.

Acanalonia brevifrons Muir.

The description by Dr. Muir is from one male from Pt. Cangrejos collected by Wolcott June 24, 1920. I have seen the type in the U. S. National Museum and it does not agree at all with specimens I collected at various points and described below.

"Acanalonia sp."

Wolcott lists an "Acanalonia sp. nov." "det Muir" near *depressa Melichar"* as "on shrub in woods at Seboruco, Laguna de San José" which would seem to be different from the one above; possibly the same as I describe below.

Acanalonia coniceps n sp.

Head narrower than pronotum, acutely conic; vertex flattened margins converging to acute tip; front as wide as long, somewhat tumid, widening below, margins elevated; elytra broad, costa strongly convex; neuration conspicuous, reticulate, concolorous except costa and mid-vein which are narrowly pale yellow. Color

bright green; a pale green or yellowish green median stripe from vertex to scutellum. Face and below paler, tibia pale brown.

Length to tip of elytra 9 mm.

Described from a series of six specimens collected at Salinas, Jan. 21 and March 12 on bushes and rank grass.

Ormenis infuscata Stal.

Recorded by Wolcott as occurring on sugar cane, grape fruit and coffee, but I did not find it in any numbers.

Ormenis marginata Brunnich.

Taken in large numbers on a variety of plants, especially on *Lantana* and *Cordia* at Yauco and Ensenada, Aguirre and other points throughout the island.

Ormenis pygmaea Fabricius.

Very abundant on a variety of plants and taken in nearly every locality where collections were made, so that it must be considered a very general feeder. Wolcott's extended list of host plants is representative of its very general food habits.

Ormenis quadripunctata Fabricius.

This is another very common and abundant species occurring on many different plants and in Wolcott's report credited with occurring in all stages on sugar cane as well as *Cordia*, *Lantana* and other host plants. I found it particularly abundant on "fiddle wood" (*Pedula?*) trees near Salinas.

Ormenis pseudomarginata Muir.

This species was described by Muir (1924) from one male from Porto Rico (R. T. Cotton, January, 1917) and one male from Lares, Porte Rico (J. More, Dec. 1920). I have not seen specimens that could be placed here and no indication is given as to habitat.

Flatoides sp. s.

Wolcott records two species in this genus without specific name and Muir describes *F. brunneus* from Santo Domingo. I took large numbers at Salinas on Fiddlewood and other tree trunks and no sea grape but they do not agree with Muir's description or other species I have been able to compare them with. Several species which might include my specimens have been described and I believe it best not to give a new description here.

Copicerus irroratus. Schwartz.

This is a very widely distributed species in subtropical America occurring in the other West Indian islands and in Mexico and Central America, south to Guatemala, Nicaragua and Panama; but only one specimen was taken in Porto Rico, at Añasco, March 1, so I conclude it must have been exceedingly rare in the localities in which I collected. No previous records for the island appear to have been made.

Stobaera tricarinata Say.

A specimen agreeing very well with representative specimens from the States was taken at Aguirre, Feb. 18. Not recorded by Wolcott.

Megamelanus elongatus Ball.

Specimens taken on beach grass near San Juan Feb. 10th are slightly smaller than specimens I have from New Orleans, La., but agree so closely in other respects that I believe them to be one species. They are evidently confined to beach grass as food plant.

Pissonotus albovenosa Dozier.

Taken at Río Piedras in the Experiment Station garden Feb. 14. This is a strikingly marked little species hitherto known from Mississippi.

Saccharosydne saccharivora Westwood.

This common and widely distributed species is well known as occurring on sugar cane and is at times quite injurious. It was taken at a number of localities but at no time during my stay was it found in great numbers on cane. It was taken at different times on grasses, sometimes at points quite distant from cane fields.

Peregrinus maidis Ashmead.

Taken on corn at Ensenada, Tallaboa and Ciales and doubtless occurs generally where corn is grown. The species is known for many different countries including Cuba, Southern United States, Hawaii, Ceylon and South Africa. It is of special interest in connection with possible transmission of mosaic disease, but it does not appear to breed on sugar cane. Occurrence of adults on this plant might, however, serve as a means of transmission for plant diseases ocurring on grasses or corn.

Neomalaxa flava Muir.

Recorded by Wolcott as occurring on cohitre grass *Commelina elegans* at different points.

Nilaparvata wolcotti Muir.

Wolcott records this as occurring on malojillo grass at Pt. Cangrejos.

Sogota cubanus Crawford.

This species is reported by Wolcott as occurring on rice, carrots and sugar cane. I took it at Río Piedras Feb. 14, Cayey Rd. Jan. 28.

Sogata approximata Crawford.

Reported as occurring on malojillo grass at Pt. Cangrejos and on grasses in cane fields by Wolcott.

Delphacodes havanensis Crawford.

Reported by Wolcott as occurring on malojillo grass at Pt. Cangrejos.

Delphacodes humilis Van Duzee.

This abundant species on grasses was recorded for malojillo grass at Pt. Cangrejos and on Guinea grass by Wolcott. Specimens referred here were collected at numerous points.

Delphacodes propinqua Fieber.

Another common species for the West Indies and adjacent mainland. Recorded for malojillo grass by Wolcott. Our records are for Río Piedras, Aguirre, Mayagüez, and Fortuna.

Delphacodes teapae Fowler.

This is one of the most abundant species of Delphacid on the island and was taken at practically every locality where I collected. Wolcott says "at light, on sugar cane, on malojillo and carpet grass, carrots" etc. I took it most abundantly on grasses and frequently adjacent to sugar-cane fields.

Delphacodes albolineosa Fowler.

Specimens referred here were taken at Río Piedras, Feb. 14.

Delphacodes andromeda Van Duzee.

Taken at Patillas Jan. 22 and Lares Feb. 12th.

Delphacodes erectus (var. **nigripennis**) Crawford.

Salinas March 12 and Cayey Road at about 2,000 ft. elevation March 16.

Delphacodes puella Van Duzee.

Taken only rarely and in small numbers. Aguirre Jan. 18, Añasco March 1.

Delphacodes lutulenta Van Duzee.

Specimens agreeing closely with specimen taken in the States were taken at Río Piedras, Mayagüez, Cayey road and Aguirre.

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REFERENCES

1. **Cook, M. T.** and **Gleason, H. A.** 1928. Ecological Survey of the Flora of Porto Rico. Jour. Dept. Agr., Porto Rico, **12**: 1–139, plates 1–74.
2. **Davis, W. T.** 1928. The Cicadas of Porto Rico with Descriptions of a New Genus and Species. Jour. New York Ento. Soc., **34**: 29–33.
3. **DeLong, D. M.** 1923 (With Wolcott.) Describes New Species in Insectae Portoricensis. Jour. Dept. Agr. Porto Rico, **7**: 1–313.
4. **Dozier, H. L.** 1927. Some New and Interesting Porto Rican Leaf-hoppers. Jour. Dept. Agr., Porto Rico, **10**: 259–265.
5. **McAtee W. L.** 1924. Florida Entomologist **8**: 34.
6. **Muir, F.** 1924. New and Little Known Fulgorids from the West Indies (Homoptera) Proc. Hawaiian Ent. Soc. **5**: 461–472.
7. **Osborn, H.** 1926. Faunistic and Ecologic Notes on Cuban Homoptera. Annals of Ento. Soc. America, **19**: 335–363.
8. —— 1929. Leafhopper Immigrants of Economic Importance. Jour. Econ. Ent., **22**: 209–213.
9. —— 1928. Neotropic Homoptera in the Carnegie Museum. Annals Carnegie Museum, **18**: 253–296.
10. **Uhler, P. R.** 1895. Homopterous insects from the Island of St. Vincent, Proc. Zool. Soc. London, 1895 pp. 55–84.
11. **Van Duzee, E. P.** 1907. Jamaica Hemiptera. Bul. Buffalo Soc. Nat. Sci., **8**: 1–79.
12. **Walker, F.** 1857–'58. Homoptera in the British Museum. Pts. I–II–III, and Supplement.
13. **Wolcott, G. N.** 1923. Insectae Portoricensis. Jour. Dept. Agr., Porto Rico, **7**: 1–313.

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